

LEGO DACTA®

Control LAB™

Setup Guide and Introductory Explorations



The *educational* division of the LEGO Group.

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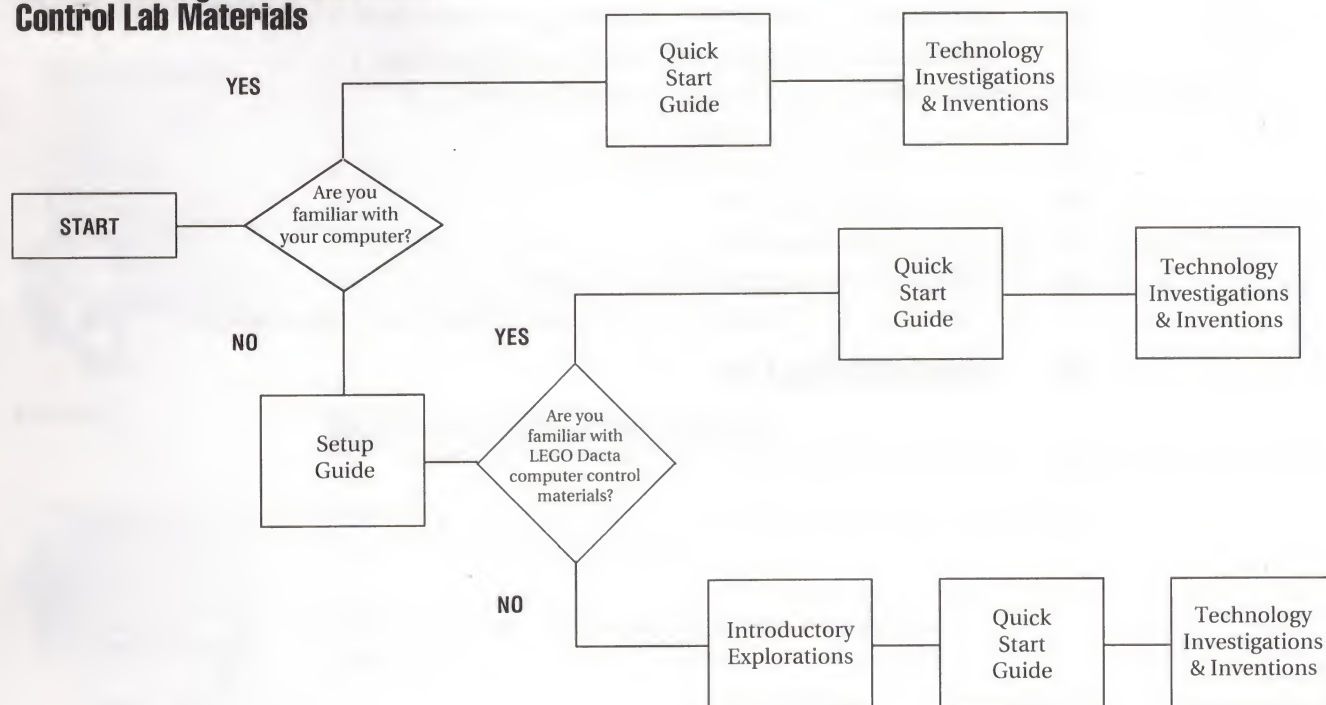
Setup Guide and Introductory Explorations

The *Setup Guide* is for users who are not completely familiar with their computer or the concept of computer control. The *Introductory Explorations* is also designed as a very simple introduction to the LEGO® elements and how to use them with a computer.

Are you already quite familiar with your computer? Do you have experience using control technology? If so, you may wish to go through the book entitled *Quick Start Guide* instead of this book.

The diagram below illustrates different pathways through the literature in the LEGO DACTA® Control Lab™ system.

Routes Through the LEGO DACTA® Control Lab Materials



► Registration - Do This First!

Please fill out the enclosed customer registration card now and mail it in. By returning the card, your software license will be acknowledged by LEGO Dacta and you will receive information about enhancements to the LEGO Dacta system.

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Setup Guide

Teacher note:

The *Setup Guide* is written for either the students or the teacher to use.

If you are planning to have students set up their own work stations, you may wish to photocopy the *Setup Guide Progress Checklist* at the end of the *Setup Guide* section.



Item #9751



Item #9769 for Macintosh



Item #9768 for MS-DOS

Please make sure you are acquainted with some fundamental aspects of your Macintosh® or MS-DOS® computer before proceeding.

You should be familiar with these components:

- Keyboard
- Monitor screen
- Disk drive
- Floppy disk
- Mouse
- Printer

You should know how to do the following using a mouse:

- Point to an object
- Click on an object to select it
- Drag a selected object to a new location or select from a menu
- Double click on an object
- Shift click on an object

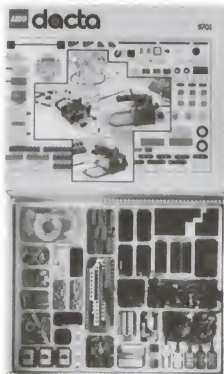
If you are not familiar with these mouse actions, please consult your Macintosh or MS-DOS computer manuals before proceeding.

Inventory the Components

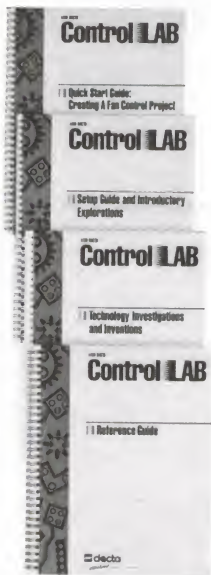
You should have on hand the following components for the LEGO DACTA Control Lab system:

LEGO DACTA Serial Interface and transformer
(item #9751)

LEGO DACTA Cable
(item #9769 for Macintosh computers)
(item #9768 for MS-DOS computers)



Item #9701. The building cards are underneath the yellow tray.



Item #998

It is possible to run Control Lab from the 3.5" or 5.25" high density disk drive of an MS-DOS computer system but it is not recommended because of the system speed and memory demands.

LEGO DACTA® Control Lab Software on disk
(item #066 individual or #068 site license for Macintosh computers. Both items include: 2 x 3.5" disks: 1 high density color; 1 double density black and white)
(item #067 individual or #065 site license for MS-DOS computers. Both items include: 1 x 5.25" high density disk, 2 x 3.5" double density disks)

LEGO DACTA Technology Set with building cards
(item #9701)

LEGO DACTA Control Lab Literature Pack
(item #998) *Setup Guide and Introductory Explorations*
Quick Start Guide
Technology Investigations and Inventions
Reference Guide

You should also have a Macintosh or MS-DOS computer which meets the following minimum requirements.

Macintosh

- 1 megabyte (MB) RAM
- System 6.0 or higher
- Finder 6.0 or higher
- 1 serial modem or printer port available
- Color or monochrome monitor
- Hard disk
- To load the color version, you must have a high density 3.5" disk drive

Item #066 or #068 for Macintosh.



Item #067 or #065 for MS-DOS

MS-DOS

- 640 kilobytes (K) RAM
- DOS version 3.1 or higher
- Mouse
- Mouse driver 6.24 or higher (Microsoft® standard)
- 1 serial port (in addition to mouse port)
- EGA color or monochrome monitor
- Hard disk
- A 3.5" disk drive or a high density 5.25" disk drive



LEGO DACTA® Control Lab System Overview



Systems Diagram

All systems include three parts: input, process and output. The LEGO DACTA Control Lab materials, when they are connected together, make a system.

There are three types of input into the Control Lab system: the commands you type on the keyboard, the clicks you make with the computer mouse, and the feedback from the Control Lab sensors.

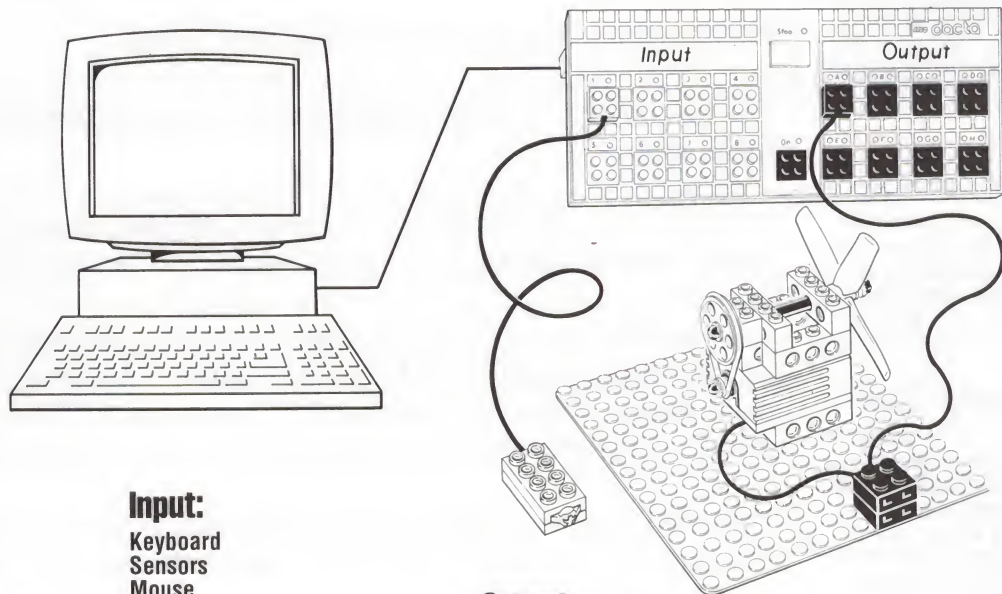
The process component of Control Lab includes the computer, the Control Lab Software, Cable and Serial Interface. Input into the Control Lab system is processed by the computer and the software. Instructions are communicated through the cable to the interface box.

The output components of the Control Lab system include the motors, lamps and sound elements which are included in the LEGO DACTA Technology building set. Many different types of models can be built using LEGO® elements and these output devices. The output can also be the computer screen.

The following is an example of the Control Lab system.

Process:

Computer and Serial Interface box interpret the input



Input:
Keyboard
Sensors
Mouse

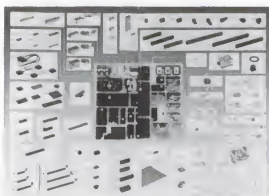
Output:

Action by LEGO components
Computer screen display

Throughout the Control Lab materials, the ► symbol indicates an action that must be taken.

► **Teacher note:**

You may wish to have everyone use the Setup Guide Progress Chart checklist as a guide for installing the interface box, transformer, and cable. A copymaster is listed after the *Setup Guide* section.



Red card full page spread

► **Teacher note:**

At the end of each building session, you may wish to have students use the red card for assistance in taking inventory and storing the building elements.

► **Teacher note:**

You may wish to photocopy and hand out the Technology Set Parts List in the Supplemental Materials section of the *Technology Investigations and Inventions* book so students can become familiar with the names of the various elements.

Input: You type commands into the keyboard and press the touch sensor to turn on the fan motor.

Process: The computer and software interpret the commands to turn on the fan motor. The instructions are sent through the cable to the appropriate output port on the LEGO DACTA® Serial Interface box.

Output: The fan motor turns on.

Follow the *Setup Guide* to connect the LEGO DACTA Control Lab system. Then try the *Introductory Explorations* to learn how to use the Control Lab inputs and outputs.

Prepare the Components

Building Set

► Open the LEGO DACTA Technology Set box (item #9701).

Inside is a large yellow tray with bins, several bags of building elements, and a packet of eight large building cards. The building cards are underneath the yellow tray.

The building cards include one with a red border and seven with a blue border, labelled 9701-1 through 9701-7.

► Open the red card to the first full page spread.

The photograph and diagrams show the organization of the building set for storage.

► Open each bag of building elements and place them in the appropriate bin in the storage tray, according to the photograph and diagram.

You may wish to count the number of building elements as you store them. If you do, notice that the count of each element is written on the page. For example, the notation “4x” next to the red brick in the bottom middle of the page means you should have four of the bricks.

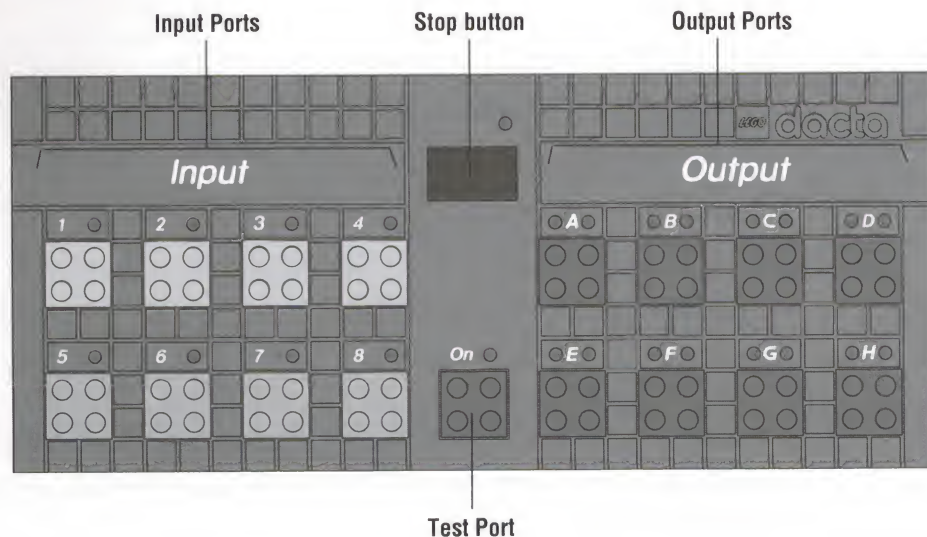
The axle lengths are measured in **studs** – the bumps on top of the bricks. The bold faced number next to the axles indicates how many studs long the axles are.

Teacher note:

Inspect the Control Lab materials to make sure they are in good condition. If you detect any apparent damage, call Consumer Affairs, LEGO Systems, Inc. for service at 203-763-3211. The interface and transformer are covered by a limited one-year warranty which is included in the carton. Please read the warranty carefully.

LEGO DACTA® Serial Interface and Transformer

- Open the carton containing the Serial Interface and transformer (item #9751).
- Find the *Directions For Use* booklet. Read through the USA/CAN (the United States and Canadian version) instructions to become familiar with the various ports on the interface box.



The large red **Stop button** cuts off the electrical power to the output ports without using computer commands. For example, if you need to halt the operation of a motorized model immediately, you can press the Stop button.

The black **output ports** (labelled A through H) provide electrical power to motors, lamps, and sound elements.

The **test port** (labelled On) is located directly beneath the red Stop button.

The yellow and blue **input ports** transfer information from sensors to the computer. The four yellow input ports are labeled 1 through 4. Immediately below them are four blue input ports labeled 5 through 8.

The *Introductory Explorations* explain how to use the ports on the interface box.

LEGO DACTA® Cable

► Open the bag containing the **LEGO DACTA® cable**; either item #9769 for Macintosh or #9768 for MS-DOS.

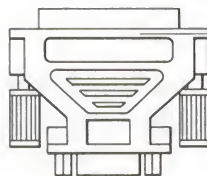
Attach to interface box.

Attach to serial port on computer.



Macintosh Cable

The MS-DOS cable package also contains a 9 to 25-pin converter which you may need depending on the particular MS-DOS computer model you are using.



If necessary, attach 9-to-25-pin converter to cable, then attach to 25-pin serial port on computer.

Attach to interface box.

Attach to 9-pin serial port on computer.



MS-DOS Cable

Install the LEGO DACTA® Serial Interface, Transformer, and Cable

- Turn off the computer.

Identify the end of the cable with nine pins protruding: a row of five and a row of four.

- Connect this end of the cable to the back of the interface box and tighten the thumbscrews to hold the cable in place.

It will fit in only one orientation, with the row of five pins on top.

- Connect the other end of the cable to the modem port of your Macintosh or to any **serial** port on your MS-DOS computer.

- Connect the transformer cord to the back of the interface box.

Macintosh note:

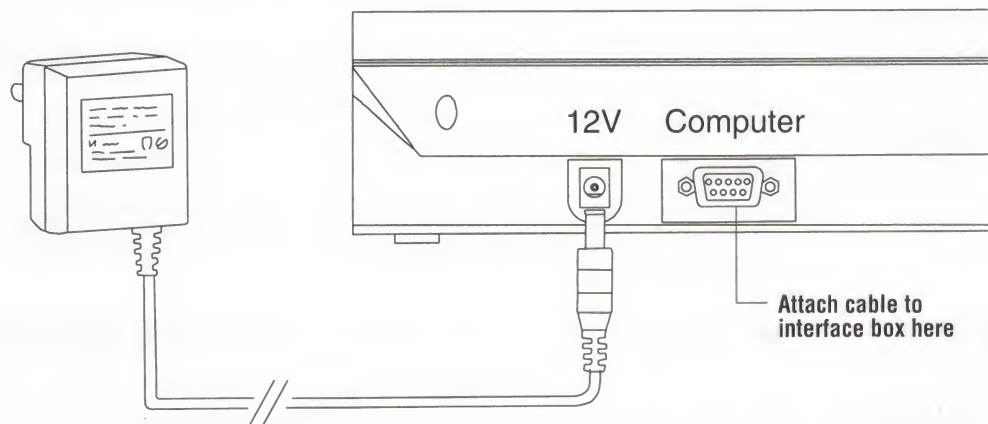
If the modem port is already in use, you can connect the cable to the printer port.



When you start up the Control Lab software, you will have to make a simple adjustment to the software so the computer knows that the cable is connected to the printer port.

MS-DOS note:

If the serial port on the MS-DOS computer is a 25-pin port use the pin converter furnished. Plug it onto the end of the cable with nine holes.



- Plug the transformer into an electrical power socket.

The small green indicator light next to the word **On** over the black test port should light up. This shows that the interface box is receiving electrical power. The red light over the **Stop** button also lights up because the software is not yet running.

Teacher note:

If the green light still does not turn on, call LEGO DACTA at 800-527-8339 and ask for technical support.

If the green indicator light is not on, check the transformer to make sure it is plugged in properly and that electrical power is being delivered to the socket into which the transformer is plugged.

Install the LEGO DACTA® Control Lab Software

Follow the instructions below to install the Control Lab software on a hard disk.

- ▶ Start the computer.
- ▶ Insert the Control Lab floppy disk. Follow the appropriate instructions below to complete the software installation.

Macintosh

The Control Lab disk icon appears on the monitor screen.

- ▶ Open the Control Lab disk by double clicking on the disk icon.
- ▶ Locate the Control Lab software icon.
- ▶ Drag the Control Lab icon onto the hard disk icon.

The computer copies the Control Lab software onto your hard disk drive.

- ▶ Remove the original Control Lab disk from the disk drive. This is your backup copy so store it in a safe place.

MS-DOS

- ▶ At the C> prompt, type `md ctrlab` to create a subdirectory for Control Lab.

- ▶ Next, type `cd ctrlab` to get into the Control Lab subdirectory.

- ▶ Then type `copy a:*. * c:` to copy the Control Lab software into the `ctrlab` directory on the hard disk.

The computer copies the Control Lab software onto your hard disk drive.

- ▶ Remove the original Control Lab disk from the disk drive. This is your backup copy so store it in a safe place.

Setup Guide Summary

Congratulations! You have set up the Control Lab system for use. Now you are prepared to explore how the system components work.



CtrlLab 1.0

Macintosh users:

Control Lab software is shipped on two disks: one 3.5" black and white version and one 3.5" color version. Choose the appropriate disk for your computer.

MS-DOS users:

Control Lab software is shipped on two 3.5" double density disks or one 5.25" high density disk. Choose the appropriate size for your computer. If you use the 3.5" disks, remember to copy files from both disks.

Setup Guide Progress Checklist

Prepare the Components

- ☐ Open the LEGO DACTA® Technology Set box (item #9701).
- ☐ Open the red card to the first full page spread.
- ☐ Open each bag of building elements and place them in the appropriate bin in the storage tray, according to the photograph and diagram.
- ☐ Open the carton containing the LEGO DACTA Serial Interface and transformer (item #9751).
- ☐ Find the *Directions For Use* booklet. Read through the USA/CAN (the United States and Canada version) instructions to become familiar with the various ports on the interface box.
- ☐ Open the bag containing the LEGO DACTA Cable; either item #9769 for Macintosh or #9768 for MS-DOS.

Install the Serial Interface, Transformer and Cable

- ☐ Turn off the computer.
- ☐ Identify the end of the cable with nine pins protruding: a row of five and a row of four.
- ☐ Connect this end of the cable to the back of the interface box and tighten the thumbscrews to hold the cable in place.
- ☐ Connect the other end of the cable to the modem port of your Macintosh or to any serial port on your MS-DOS computer.
- ☐ Connect the transformer cord to the back of the interface box.
- ☐ Plug the transformer into an electrical power socket.

Install the Software

- ☐ Start the computer.
- ☐ Insert the Control Lab floppy disk. Follow the appropriate instructions below to complete the software installation.

Macintosh

- ☐ Open the Control Lab disk by double clicking on the disk icon.
- ☐ Locate the Control Lab software icon.
- ☐ Drag the Control Lab icon onto the hard disk icon.
- ☐ Remove the original Control Lab disk from the disk drive. This is your backup copy so store it in a safe place.

MS-DOS

- ☐ At the C> prompt, type `md ctrlab` to create a subdirectory for Control Lab.
- ☐ Next, type `cd ctrlab` to get into the Control Lab subdirectory.
- ☐ Then type `copy a:*. * c:` to copy the Control Lab software into the `ctrlab` directory on the hard disk.
- ☐ Remove the original Control Lab disk from the disk drive. This is your backup copy so store it in a safe place.

Introductory Explorations

Teacher note:

You may wish to photocopy the Introductory Explorations Progress Checklist at the end of the book for all those who will be working on the explorations.

If you are already familiar with LEGO DACTA® computer control products and want an introduction designed for more experienced users, you may wish to skip to page 6 of the *Quick Start Guide*.

The pages that follow contain simple introductory activities for learning about the various components of the LEGO DACTA Control Lab system. No previous knowledge of LEGO® components is assumed.

Explorations 1 through 3 require about 30-45 minutes each. Exploration 4 requires about 60-90 minutes.

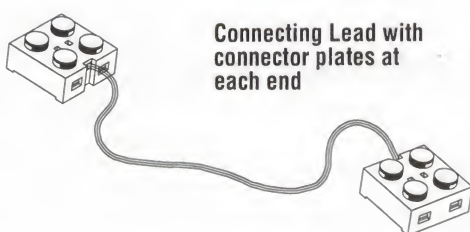
Exploration 1: The Motor, Lamp, and Sound Elements

► Make sure the LEGO DACTA Serial Interface is connected to the computer and is being powered by the transformer.

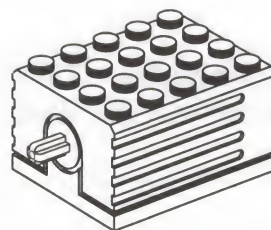
The green indicator light above the test port should be shining.

It is not necessary to turn on your computer or to start up the Control Lab software yet. The red light above the Stop button is shining because the Control Lab software is not running.

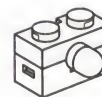
► From the Technology building set (item #9701), take out one **motor**, one **lamp**, one **sound element** and one **connecting lead**.



Connecting Lead with connector plates at each end



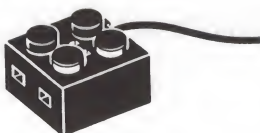
Motor



Lamp



Sound Element



► Pick up the **connector plate** on the end of the connecting lead. Find the small metal parts in the studs on top of the connector plates at the ends of the wires.



► Find the metal edges in the recessed bottom of the connector plate.

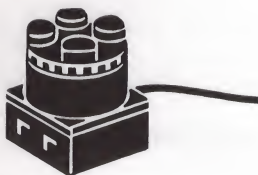
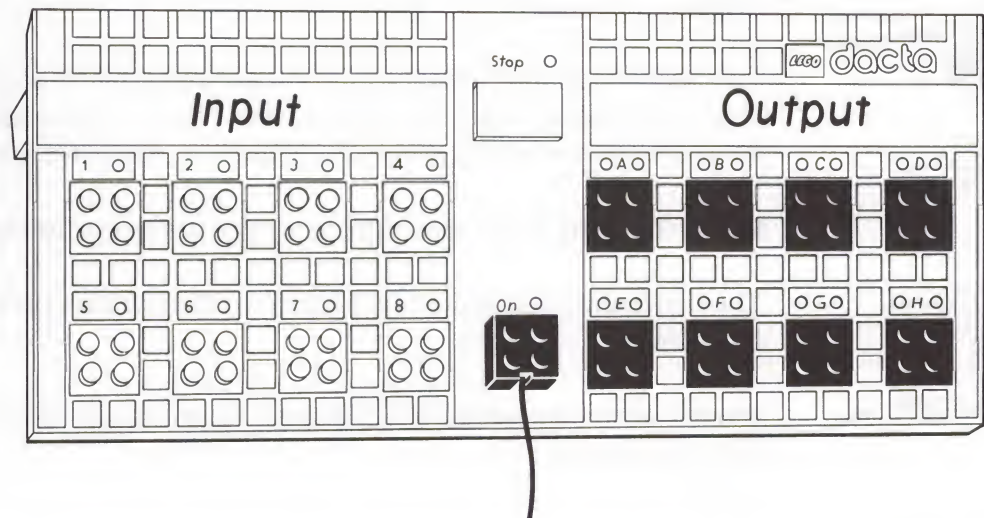
Connector Plate

These metal components provide a pathway for the electricity so it can travel along the **wires**. This plate is called a 2x2 plate because it has two rows of two studs each.

► Examine the motor, lamp and sound element. Find the metal components which provide an electrical path through the element.

Note that neither the motor nor the sound element have metal parts in the studs on top.

► Clip the bottom of one connector plate to the test port on the LEGO DACTA® Serial Interface box. Let the connecting lead hang down from the test port toward the bottom of the interface box.



Sound Element on
Connector Plate

► Clip the bottom of the sound element to the four studs on top of the other connector plate on the connecting lead.

► Grasp the top of the sound element and turn it. Listen to the sound.

► Explore how to control the sound by turning the top of the sound element.

The sound element produces two different sounds, depending on the polarity of the electricity current flow. Turning the top of the sound element changes the direction of the electricity. The top has four positions. Two positions stop the flow of electricity and produce no sound. The other two positions produce two different sounds.

► Does the sound element work if it is clipped onto only two of the four studs on the connector plate? Be sure to turn the top of the sound element to all four positions.

Yes, the sound element does work when it is connected to the two studs nearest the wire of the connecting lead or to the two studs farthest from the wire of the connecting lead. However, the sound element does not work if it is only connected to two studs on the right or left because the studs on the sides are the same voltage. In order for electricity to flow, a difference in voltage is needed.

► If the connector plate is fastened to the studs on top of the sound element, is any sound produced?

No, because there are no metallic studs on top of the sound element.

► Replace the sound element with the lamp. Notice that the lamp lights up when it is clipped to the top or the bottom of the connector plate.

The base of the lamp can be clipped onto the top or bottom of the connector plate. The lamp lights when connected to the two studs nearest the wire or to the two studs farthest from the wire.

► Put the lamp aside and clip the motor to the connector plate.

The connector plate must be clipped to the contact points on the bottom of the motor.

When connected correctly the motor begins to run with a smooth humming sound.

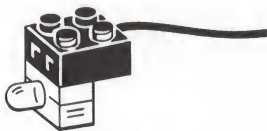
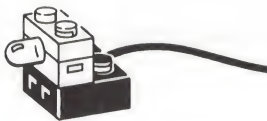
► Explore the possible connection combinations.

► Can you find any connections for which the motor does not run?

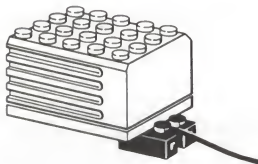
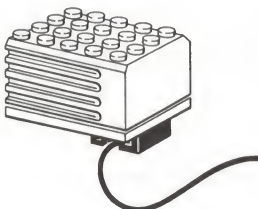
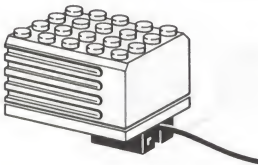
The motor does not run if only two side studs from the connector plate are inserted into the electrical contact points or if the studs from the connector plate are inserted into any nonmetallic LEGO® element.

Also the motor does not run if the connector plate is fastened to the top of the motor since there are no metallic parts there.

► Can you connect both the sound element and the lamp to the end of the connecting lead to produce both light and sound? Can you connect the motor, the lamp and the sound element so that all three are running at once?



Lamp Element on Connector Plate



Motor Element on Connector Plate

Yes, there are several ways to connect the elements to one lead.

► Disconnect all elements from the connecting lead. Disconnect the connecting lead from the test port.

Exploration 1 Summary

Now you know how to:

- Attach a connecting lead to the test port.
- Attach a sound element, a lamp and a motor to a connecting lead.

Exploration 2:

LEGO DACTA® Control Lab Software - Making Connections

See the Troubleshooting Help section at the end of the book if you have difficulty starting the Control Lab system.

For this exploration, you will need one motor, one lamp, one sound element and three connecting leads.

► Make sure the LEGO DACTA Serial Interface, transformer and cable are installed properly.

See the *Setup Guide* for information if necessary.

The green light on the test port should be shining, indicating that the interface box is receiving electrical power. The red light next to the Stop button is shining if you have not started the Control Lab software.

► Turn on the computer.

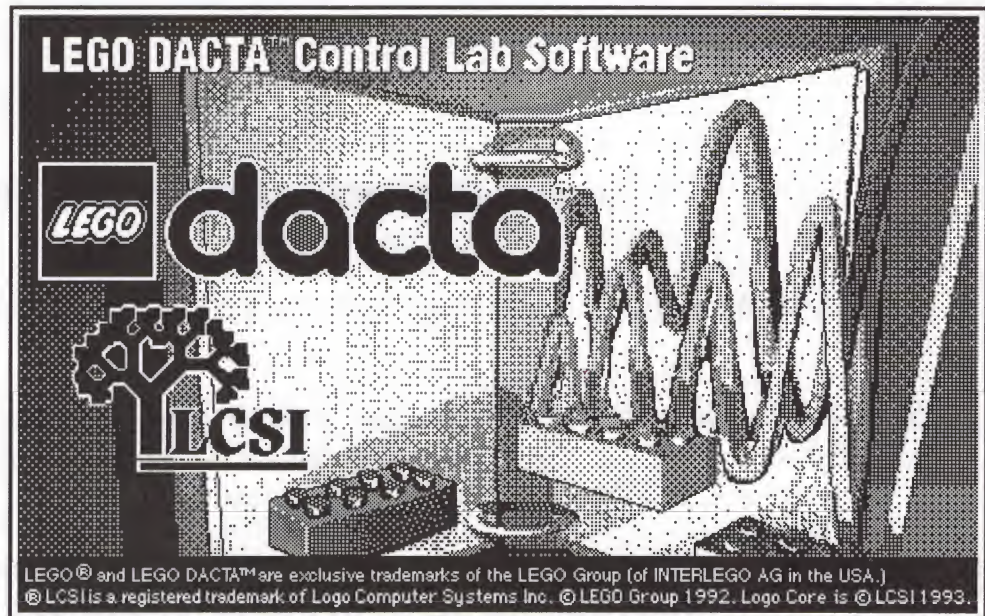
► Start the Control Lab software.

If you have a Macintosh computer, start up Control Lab by double clicking on the Control Lab icon. If you have a MS-DOS computer, type `ctrlab` and press Enter.

Teacher note:

If the software still does not load properly, write down any error messages and call LEGO Dacta at 800-527-8339. Ask for technical support.

When you see the Control Lab title screen on the monitor, you know that the software is loading successfully.



► Click on the Control Lab title screen and wait until it has changed.

► Test the LEGO DACTA® Serial Interface by pressing the red Stop button once.

The red light above the button begins flashing on and off if the interface box is functioning properly.

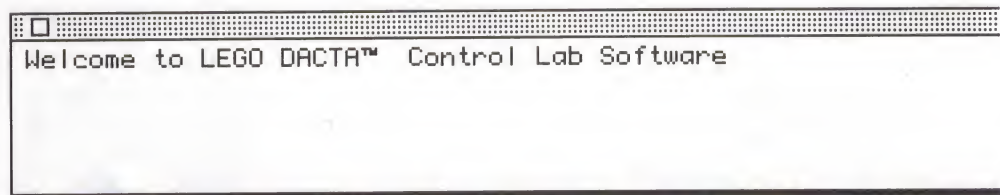
At this point, all electrical power to the black output ports is cut off.

► Push the Stop button a second time to restore power to the output ports.

The light stops flashing.

► Locate the **Command Center**: it is the window near the bottom of the screen.

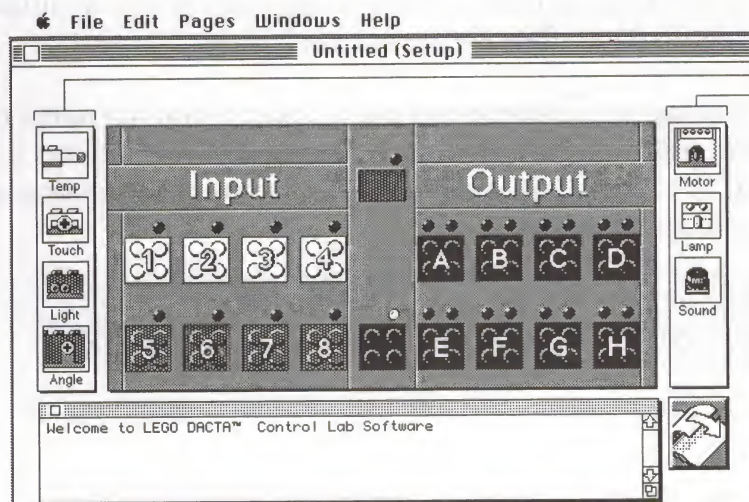
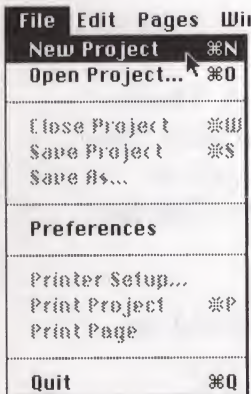
Commands you type in this window are carried out by the computer. Do not type any commands just yet.



► Select New Project from the File menu.

Control Lab files are called **projects**.

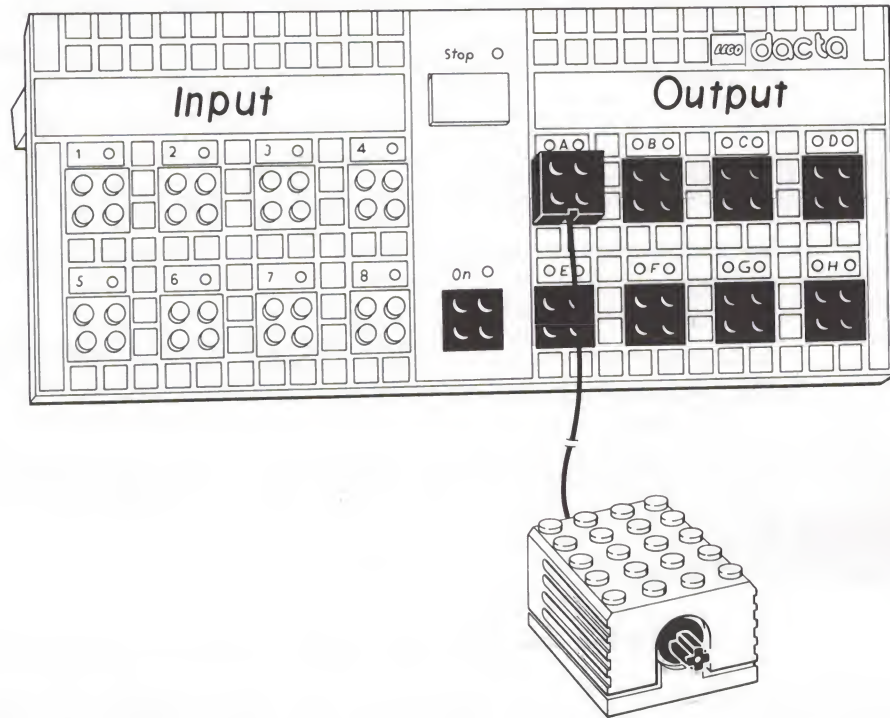
When a new project is created, the first thing you see on the screen is a picture of the interface box. This is the **Setup page**. Note the **output icons** of the motor, lamp, and sound element to the right, and the **input icons** of the various sensors to the left.



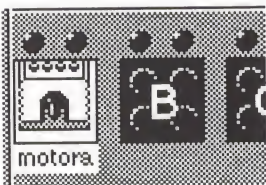
Input Icons
Output Icons

► Now look at the LEGO DACTA® Serial Interface itself. Clip one end of a connecting lead to the black output port marked with the letter A, so that the wire hangs down toward the bottom of the box.

► Connect the other end of the connecting lead to a motor.



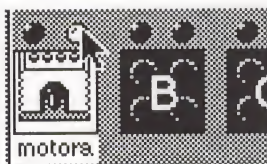
The motor does not run when it is connected to output port A. This is because no electrical power is available at output port A right now. The motor ran when it was connected to the test port because electrical power is always on in that port. Notice that the green indicator light for this port is always on.



► Select a motor **icon** with the mouse and drag it to output port A on the Setup page. Release the mouse button.

The motor icon remains on output port A and the name of the motor becomes "motora." The name "motora" simply means that LEGO DACTA Control Lab is expecting that a "motor" is connected to port "a" on the interface box.

The motor connection you made on the screen corresponds to the actual motor connection you made with the connecting lead.



► Using the mouse, point to one of the two small circles above the motor icon on the Setup page. Press down the mouse button. What happens?

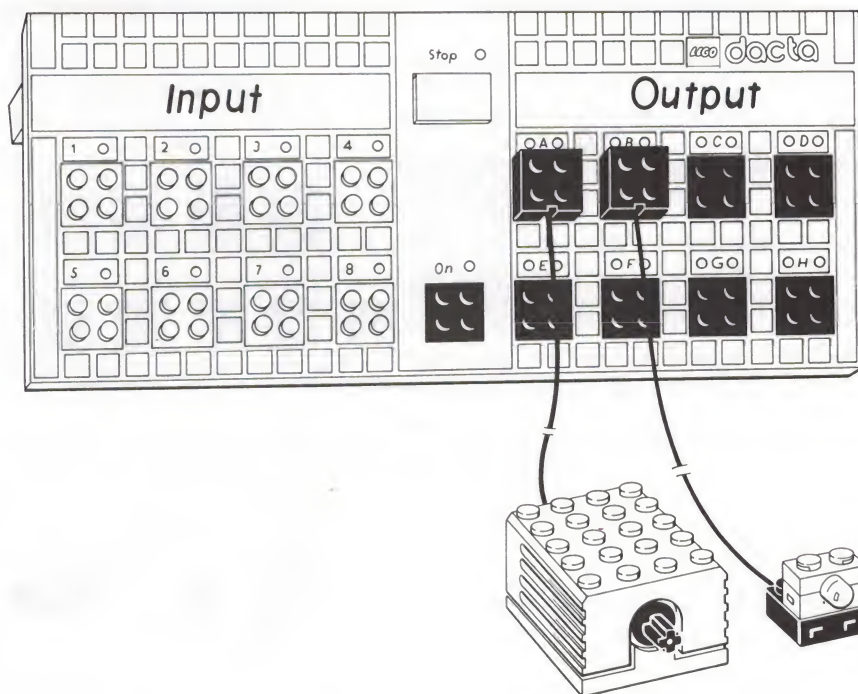
The motor runs as long as you hold down the mouse button.

► Click and hold the pointer in the other circle above port A. What happens?

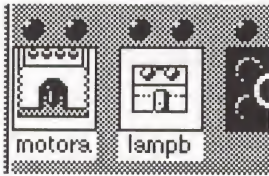
The motor runs in the opposite direction.

Note also that a corresponding green light above output A on the LEGO DACTA® Serial Interface lights up while the motor is running. Click on the circles above the other output ports on the Setup page and observe the indicator lights on the interface box.

► Clip one end of a second connecting lead to the black output port marked with the letter B, so that the wire hangs down toward the bottom of the box. Connect the other end of the connecting lead to a lamp.

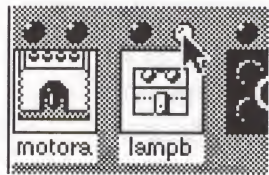


The lamp does not shine when it is connected. This is because no electrical power is available at output port B right now. The lamp turned on when it was connected to the test port earlier because electrical power in this port is always on.



- Select a lamp icon with the mouse and drag it to output port B on the Setup page. Release the mouse button. What happens?

The lamp icon remains on output port B and the name becomes "lampb." The name "lampb" simply means that LEGO DACTA® Control Lab is expecting that a "lamp" is connected to port "b" on the LEGO DACTA Serial Interface. The lamp connection you made on the screen corresponds to the actual lamp connection you made with the second connecting lead.



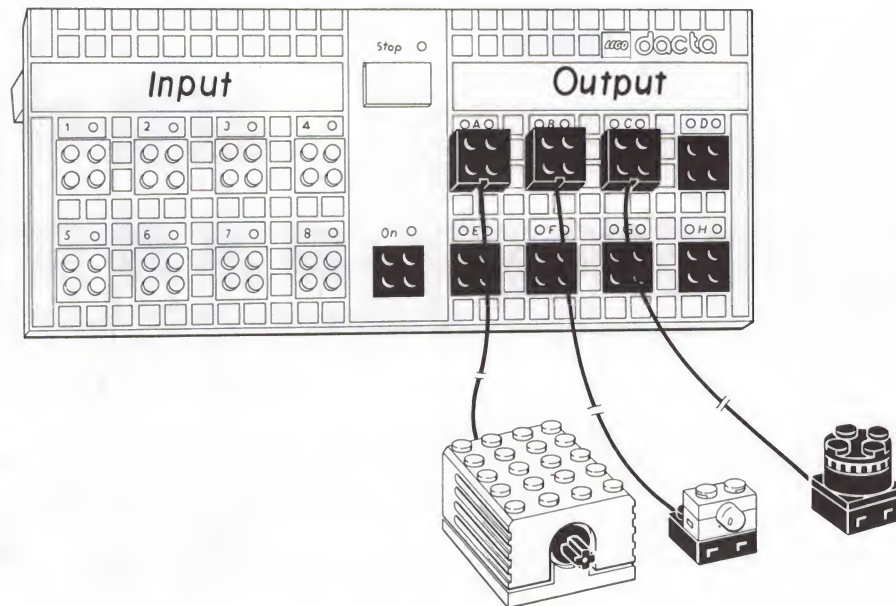
- Point to one of the two small circles above the lampb icon on the Setup page and press down the mouse button.

The lamp shines as long as you hold the mouse button down.

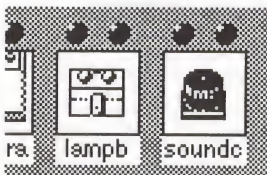
- Click and hold in the other circle above port B. What happens?

The lamp shines regardless of which direction electricity flows through it.

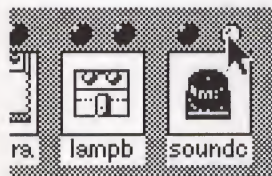
- Clip one end of a third connecting lead to the black output port marked with the letter C. Connect the other end to a sound element.



The sound element does not make a sound when it is connected because there is no electrical power available at output port C right now.



- Select a sound icon with the mouse and drag it to output port C on the Setup page.



If the sound element does not operate, turn the top of the sound element 90 degrees.

The sound icon remains on output port C and the name becomes "soundc." The name "soundc" simply means that LEGO DACTA® Control Lab is now expecting that a "sound" element is connected to port "c" on the LEGO DACTA Serial Interface, corresponding with the actual connection you made on the interface box.

► Point to one of the two small circles above the soundc icon on the Setup page and press down the mouse button. What happens?

The sound element makes a sound as long as you hold down the mouse button.

► Click and hold in the other circle above output port C. What happens?

The sound element makes another sound because the electricity is flowing through it in the opposite direction.

Exploration 2 Summary

Now you know how to:

- Connect the motor to the interface box and control its direction using the two output port circles on the Setup page.
- Connect the lamp to the interface box and activate it using the two output port circles on the Setup page.
- Connect the sound element to the interface box and control the sound it makes using the two output port circles on the Setup page.

If you want to stop work at this point, select Quit from the File menu. Otherwise, continue on with Exploration 3.

Exploration 3:

LEGO DACTA® Control Lab Software - Using Commands

During Exploration 2, you controlled the motor, lamp and sound elements by manually clicking and holding the circles above the output ports on the Setup Page. Exploration 3 explains how to operate the motor, lamp and sound element with Control Lab computer commands.

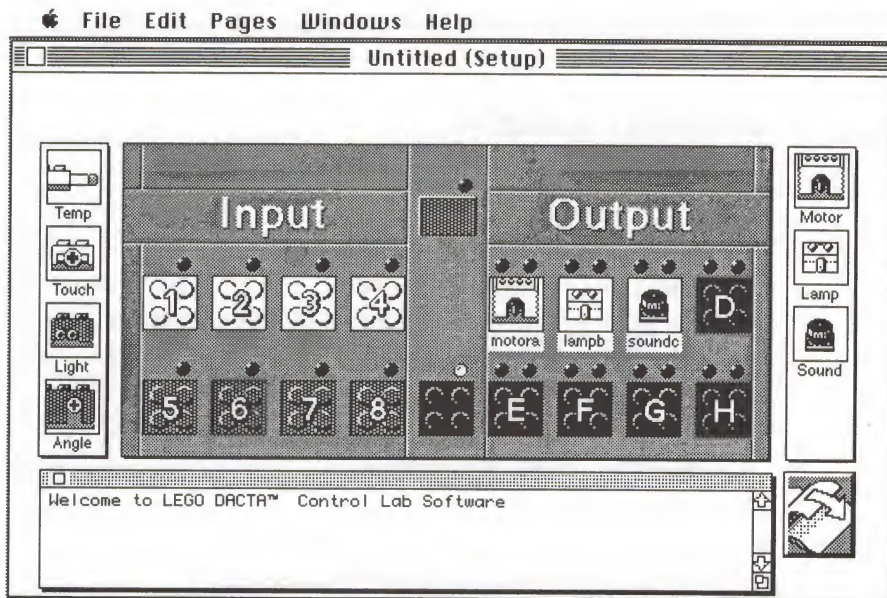
See the *Setup Guide* if you need information about this.

See Exploration 2 if you need information about this.

See the Troubleshooting Help section at the end of the book if you have difficulty starting the Control Lab system.

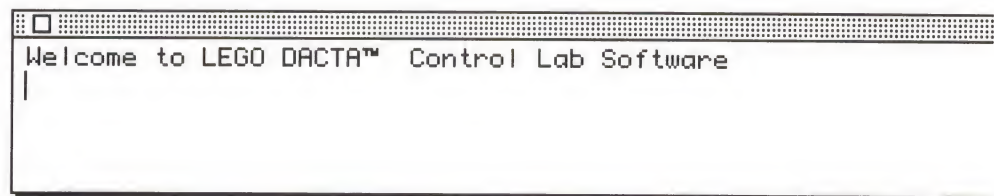
- ▶ Turn on the computer and start the Control Lab software.
- ▶ Select New Project from the File menu.
- ▶ Connect the motor to output port A, the lamp to output port B, and the sound element to output port C.
- ▶ Drag the corresponding icons to the respective ports on the Setup page.

The Setup page should look like this.



- ▶ Click in the Command Center window immediately beneath the word "Welcome" to insert the text cursor.

The cursor appears as a blinking vertical line. Anything you type appears on the screen at the cursor.



► Type the following line at the keyboard and press Return (Macintosh) or Enter (MS-DOS).

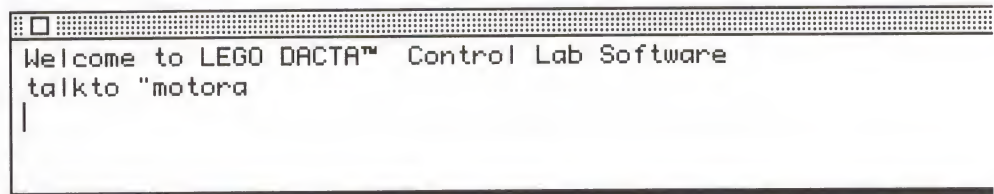
```
talkto "motora
```

You can type either all capital, all lower case or a combination of letters.

Pressing Return or Enter signals the computer to carry out the commands you type.

As you type, the words appear in the Command Center. When you press Return or Enter, the text cursor moves down to the next line.

The Command Center should look like this.



The `talkto` command tells the computer to open the electronic pathway to the motor connected to port A. It is an internal action which you cannot see. The `talkto` command does not turn on the motor; it simply prepares the way.

It is important to type in the `talkto "motora` command line exactly as shown. Otherwise, the computer may not know what to do. Note that `talkto` is one word. It is followed by a space, then a quotation mark and the word `motora`. There is no closing quotation mark used.

The LEGO DACTA® Control Lab software responds with various helpful messages when you type something in the Command Center it does not know how to carry out. Here are some examples.

Command(s)	Problem	Solution
talkto	talkto needs more inputs	Include "motora
talkto "motora"	tto does not like motora" as input	Eliminate closing quote
talkto motora	I don't know how to motora	Add front quote
talk to "motora	I don't know how to talk	Eliminate space in talkto
talkto"motora	I don't know how to talkto"motora	Add space between talkto and "motora

If Control Lab produces these or similar messages, simply type in `talkto "motora` correctly on the next line and press Return or Enter. Or, if you are familiar with how to edit text with the mouse, make the appropriate changes in the line you typed earlier and press Return or Enter.

-
- Type `on` and press Return or Enter.

The motor begins running because the computer is sending a message to direct power to port A, the output port it is “talking to.” Note that a green light over output port A on the LEGO DACTA® Serial Interface is shining.

```
□
Welcome to LEGO DACTA™ Control Lab Software
talkto "motora
on
|
```

- Press the red Stop button on the LEGO DACTA Serial Interface once. What happens?

When you press the Stop button on the interface box once, the motor stops and the red light begins flashing.

- Press the Stop button a second time. What happens?

The motor turns on again and the red light next to the Stop button turns off.

- Type `off` and press Return or Enter to turn off the motor.

```
□
Welcome to LEGO DACTA™ Control Lab Software
talkto "motora
on
off
|
```

- Turn on the motor once more.

Type `on` in the Command Center and press Return or Enter. Or, use the `on` command you have already typed. To do that, press the up-arrow (↑) key twice so the flashing text cursor is on the same line as the `on` command. Then press Return or Enter.

- Use the `talkto`, `on` and `off` commands to control the lamp and sound element.

For example, type the following.

Make sure you type square brackets [] not parentheses () or curly braces { }.

As the Command Center fills with commands, the lines begin to scroll. You can use the scroll arrows on the right side of the Command Center to move up and down to lines which have already been typed.



To place the text cursor on a line which has already been typed, simply point to the line and click the mouse button.

```
talkto "lampb
on
talkto "soundc
on
|
```

```
talkto [lampb soundc]
off
|
```

Notice that both the lamp and sound element can be addressed simultaneously using the square brackets.

- ▶ Type `alloff` or `ao` and press Return or Enter to turn off everything connected to the LEGO DACTA® Serial Interface.
- ▶ Type `cc` and press Return or Enter to clear everything you have typed in the Command Center.
- ▶ Type the following in the Command Center and press Return or Enter. What happens?

```
talkto "soundc
on
rd
```

The sound element turns on making one type of sound.

When the computer carries out the `rd` command, it reverses the direction of the electricity to the sound element. This produces a different sound. Also, the other green indicator light above output port C turns on.

- ▶ To reverse the direction once more, simply use the up-arrow key (↑) to bring the text cursor to the `rd` line in the Command Center. Then press Return or Enter. Or you can simply type `rd` again.
- ▶ Type the following in the Command Center. What happens?

Use `cc` anytime you wish to clear the Command Center.

```
talkto "motora  
on  
rd  
off
```

The motor turns on, reverses direction, then turns off.

If you observe closely, you can see the motor change direction. You can also feel the motor "kick" as it changes direction.

► Type the following, all on the same line, in the Command Center. What happens?

```
talkto "lamb on wait 30 off
```

The lamp turns on for 3 seconds, then turns off.

The computer carries out all of the above instructions, one at a time, going from left to right.

The `wait` command makes the computer pause before continuing. In this case, the number 30 tells it to pause for three seconds (or 30 tenths of a second).

► Change 30 to 50. Then press Return or Enter. What happens?

```
talkto "lamb on wait 50 off
```

The lamp turns on for 5 seconds, then turns off.

Instead of typing in the entire line again, you can use the arrow keys to move the text cursor to the right of the number 30. Then delete the number with the Delete key (Macintosh) or Backspace key (MS-DOS) and type in 50. The cursor does not have to be at the end of the line when you press Return or Enter.

► Type the following in the Command Center. What happens?

The `onfor` command combines `on`, `wait`, and `off`.

```
talkto "motora onfor 40
```

The motor turns on for 4 seconds.

Exploration 3 Summary

Now you know how to control a motor, lamp, and sound element with computer commands.

Here is a summary of the commands you have learned so far.

Command	Example	Action of Example
talkto	talkto "soundc	Prepares pathway for the computer to send instructions to output port C where a sound element is connected.
talkto [motora soundc]		Prepares pathway for the computer to send instructions to output port A where a motor is connected and port C where a sound element is connected.
on	on	Sends the instruction to power a port.
off	off	Cuts off electric power to a port.
rd	rd	Reverses direction of electricity to a port.
cc	cc	Clears the Command Center of text.
wait	wait 25	Makes computer pause 2.5 seconds.
onfor	onfor 25	Sends electric power to a port for 2.5 seconds.

If you want to stop work at this point, select Quit from the File menu. Otherwise, continue on with Exploration 4.

Exploration 4:

LEGO DACTA® Control Lab Software - Using Sensors

Sensors are like our human senses. Sensors provide information to the computer as our senses provide information to our brain.

In this exploration, you will learn to control the motor, lamp, and sound element with information from sensors.

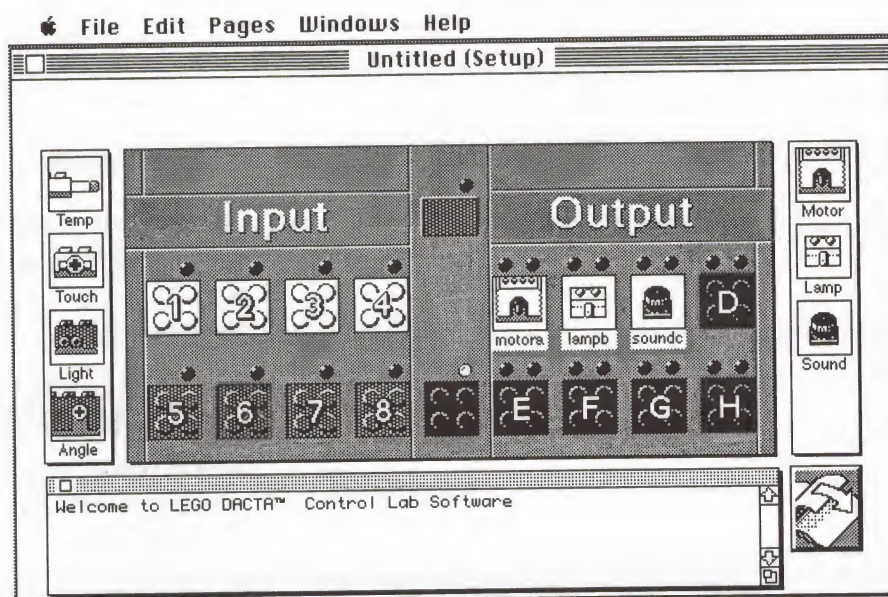
See Explorations 1 and 2 for more information if necessary.

See the Troubleshooting Help section at the end of the book if you have difficulty starting the Control Lab system.

► Turn on the computer and start the Control Lab software. Connect the motor to output port A, the lamp to output port B and the sound element to output port C.

► Drag the corresponding icons to the respective ports on the Setup page.

The Setup page should look like this.



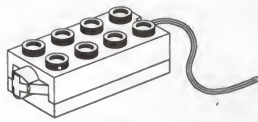
► Now look at the LEGO DACTA® Serial Interface itself. Find the yellow and blue input ports numbered 1 through 8 on the left side of the interface box.

The yellow ports are numbered 1 through 4. The blue ports are numbered 5 through 8.

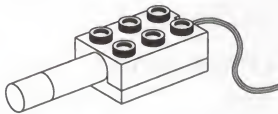
Sensors connected to these ports can provide information to the computer.

Find the yellow and blue sensors in the LEGO DACTA Technology building set.

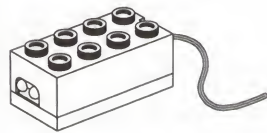
There are two categories of sensors provided with LEGO DACTA® Control Lab. The yellow sensors connect to the yellow input ports and do not require any electrical power to function. The blue sensors connect to the blue input ports and do require electrical power to function.



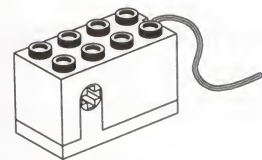
Touch Sensor



Temperature Sensor



Light Sensor



Angle Sensor

The yellow (unpowered) sensors include a **touch sensor** and a **temperature sensor**.

The blue (powered) sensors include an **angle sensor** and a **light sensor**.

Each sensor has a connecting lead permanently connected to it. Both the sensor and the end of the connecting lead are colored either yellow or blue, corresponding to the categories mentioned above.

► Find the small notch or channel at the back end of each sensor.

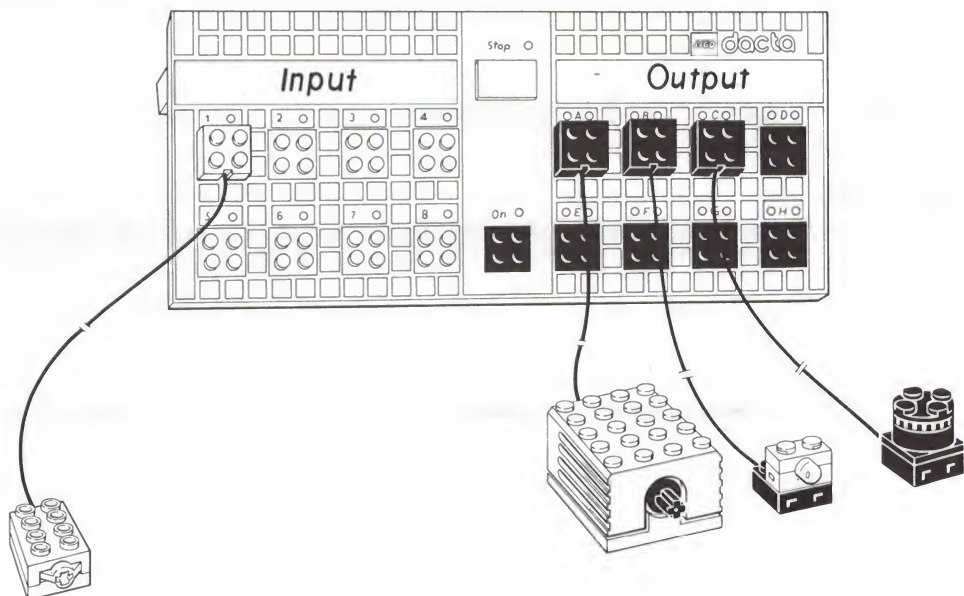
This channel gives the connecting lead wire a pathway if the back end of a sensor is placed against another building element in a model. The wire can go either up the channel or down the channel.

Since the wire provides the electrical pathway in and out of the sensor, none of the sensors have metallic studs or metal recesses. However, all of the sensors can be used as building elements and can be incorporated into the structure of models.

Touch Sensor

A touch sensor asks the question, “Am I touching something?” The answer can be “true” or “false.”

► Clip the end of the connecting lead of the yellow touch sensor to input port 1.

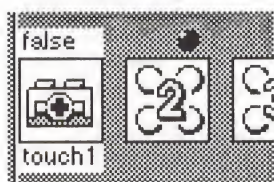


- Press the button on the touch sensor and observe the indicator light above input port 1 on the LEGO DACTA® Serial Interface.

When you press the switch, the green indicator light shines.

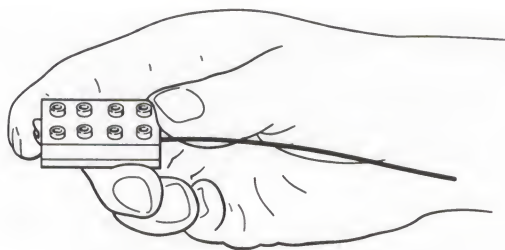
- Drag a touch sensor icon to input port 1 on the Setup page.

The touch sensor icon remains on input port 1 and the name becomes “touch1” automatically. The name “touch1” simply means that LEGO DACTA Control Lab is now expecting that a “touch” sensor is connected to input port “1” on the interface box.



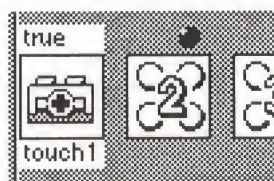
The touch sensor connection you made on the Setup page corresponds to the actual sensor connection you made on the interface box.

The word “false” appears over the touch sensor icon on the computer screen. This means that the sensor and interface box are sending “false” to the computer.



- Push in and hold down the touch sensor switch and observe what happens to the word “false.”

When the button is pressed, the sensor and the interface box send the word “true” to the computer.



- Release the switch. What happens?

The word “true” changes back to “false.”

The touch sensor is an example of a binary device. It has only two states: “true” and “false.”

- In the Command Center, type the following line and press Return or Enter.

Click in the Command Center to make it active. If it is not visible, select Command Center from the Control Lab Windows menu.

Type `touch1` as one word, with no quotation marks.

```

show touch1
false
|

```


The slanted shape of the touch sensor switch enables it to respond to pushes from an angle. The small + shaped hole in the switch accepts an axle to extend the reach of the touch sensor if necessary.

LEGO DACTA® Control Lab prints the word “false” on the next line in the Command Center. This is because at the moment you pressed Return or Enter, the sensor and the LEGO DACTA Serial Interface were sending the word “false” to the computer.

► Push in on the touch sensor switch and type the above line once again, or use the arrow keys to move the text cursor up to the line you typed a moment ago. Press Return or Enter. What happens?

When you press Return or Enter this time (make sure you are still pushing in on the touch sensor switch), Control Lab prints the word “true” on the next line in the Command Center. At the moment you pressed Return or Enter, the sensor and the interface box were sending the word “true” to the computer.

```
show touch1
false
show touch1
true
|
```

The touch sensor interacts with Control Lab as if it were forever answering the question, “Is the switch being pushed?” The answer is “false” if the switch is not being pushed, and “true” if the switch is being pushed.

► Without pressing the touch sensor, type the following line in the Command Center and press Return or Enter.

```
waituntil [touch1] talkto "motora onfor 40"
|
```

Notice that `touch1` is enclosed with square brackets `[]`, and *not* curly brackets `{ }` or parentheses `()`.

Make sure you have a motor, lamp, and sound element connected to output ports A, B, and C respectively and that the corresponding icons have been dragged to the output ports on the computer screen.

When you press Return or Enter, nothing happens to the motor. You see a small black dot appear at the end of the line in the Command Center on the computer screen. This dot means that Control Lab is carrying out the instructions in that line.

► Wait as long as you like, then press the touch sensor. What happens?

The sensor `touch1` reports "true" to the computer. LEGO DACTA® Control Lab turns on the motor and lets it run for 4 seconds (or 40 tenths of a second). The `waituntil` command makes Control Lab wait until the item in the square brackets reports "true." Then any commands following are carried out.

► Experiment in a similar fashion with the touch sensor but replace the motor with the lamp or the sound element. For example, try these statements in the Command Center. Remember to press Return or Enter. Press the touch sensor to activate the lamp or motor.

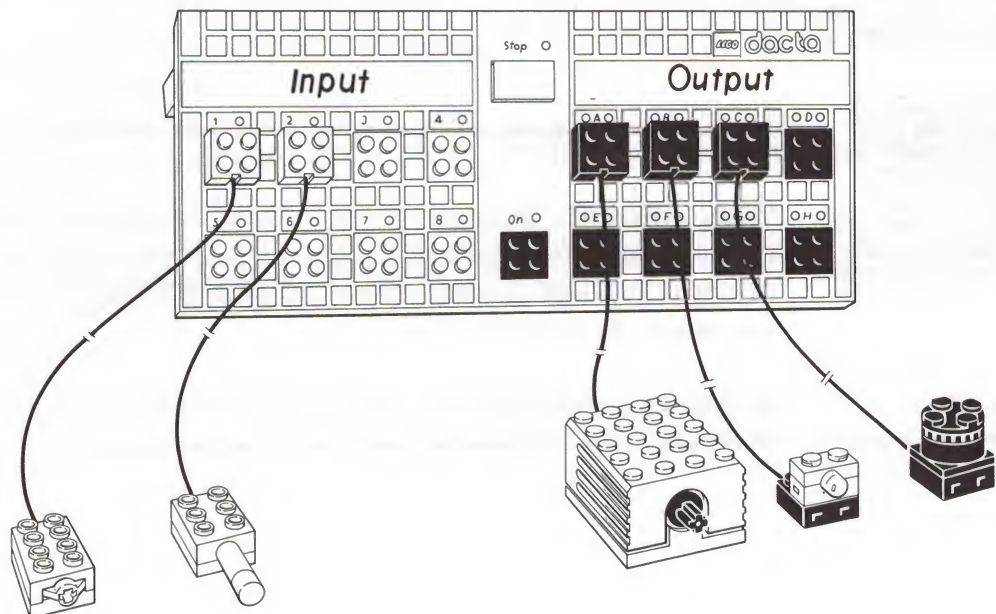
```
waituntil [touch1] talkto "lampb onfor 40•
```

```
waituntil [touch1] talkto "soundc onfor 25 rd onfor 25•
```

Temperature Sensor

A temperature sensor reports the amount of heat it senses at the metal end of its probe. The Control Lab software automatically reports the heat in terms of the Celsius scale.

► Clip the connecting lead of the temperature sensor to input port 2 on the LEGO DACTA Serial Interface.

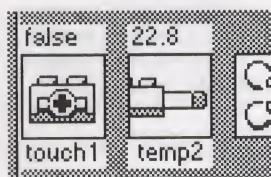


The green light above input port 2 on the LEGO DACTA® Serial Interface begins shining. This indicates that the sensor is sending information to the interface box.

► Drag a temperature sensor icon to input port 2 on the Setup page.

The temperature sensor icon remains on input port 2 and the name is changed to “temp2” automatically. The name “temp2” simply means that LEGO DACTA Control Lab is now expecting that a “temp” sensor is connected to input port “2” on the interface box.

The temperature sensor connection you made on the Setup page corresponds to the actual sensor connection you made on the interface box.

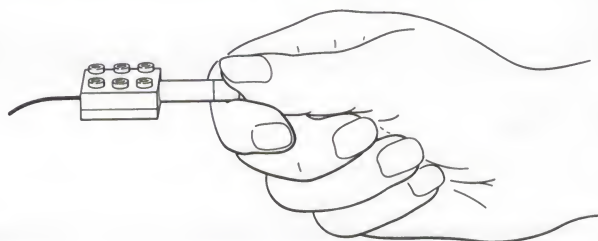


A number appears over the temperature sensor icon on the screen. Do not be concerned if your number is not the same as the number shown above. The number indicates that the sensor and interface box are sending temperature information to the computer. The number represents the temperature in degrees Celsius. In the *Quick Start Guide*, you will learn how to change to degrees Fahrenheit if you wish.

Sensors which can report specific values are called digital devices. Sensors which report a range of continuously varying values are called analog devices. The temperature sensor is actually an analog device, but the computer can report its information only in specific values. Thus, the sensor and computer combination is a digital system.

Teacher note:

Students should not place the sensor in their mouths, ears, etc. for sanitary reasons.



► Gently grasp the metallic tip of the probe with your fingers to warm it up.

In a few moments, the number over the temperature sensor icon goes up, indicating that the tip is now warmer than the surrounding air.

► After the temperature changes, release the probe.

Over the next few minutes, the number goes down. The probe absorbs heat quickly from direct contact with your skin. The air absorbs heat less quickly from the probe. This is why it usually takes a little more time in this particular experiment for the temperature reading to go down than to go up.

► In the Command Center, type the following line and press Return or Enter.

Click in the Command Center to make it active. If it is not visible, select Command Center from the Control Lab Windows menu.

Type `temp2` as one word, with no quotation marks.

```
show temp2
22.8
|
```

When you press Return or Enter, LEGO DACTA Control Lab prints the temperature reading at that moment on the next line in the Command Center.

- Select a number which is a few degrees higher than the current temperature sensor reading and which you can obtain with the heat from your fingers.

For example, if the current reading is about 24, you could select 27.

- Make sure that the motor is still connected to output port A.
- Type the following line in the Command Center and press Return or Enter. Remember to substitute your number for 27.

Make sure you use square brackets. The ">" symbol means "greater than."

Make sure you leave a space. Type a space before and after the ">" sign.

```
waituntil [temp2 > 27] talkto "motora on
|
```

- Warm the metallic tip of the probe by grasping it again.

As the temperature rises, the number above the temperature sensor icon on the Setup page goes up. When it is greater than the number you typed in, Control Lab turns on the motor. This is how the thermostat works in heating and air conditioning units.

- Release the probe.
- Quickly, before the temperature drops, select a number one or two degrees below the temperature reading. Type the following in the Command Center or change the above line to read as follows. Press Return or Enter.

Remember to substitute your number for 26.

The yellow temperature sensor has no moving parts. The metallic tip of the probe contains a temperature sensing device. You can submerge the probe in water (but not the brick part!) to measure the temperature. The temperature range for the sensor is from -20 to +50 degrees Celsius or -4 to +140 degrees Fahrenheit. This means you will be able to measure the temperature of water as it freezes (0 degrees Celsius or 32 degrees Fahrenheit), but not the temperature of water as it boils (100 degrees Celsius or 212 degrees Fahrenheit).

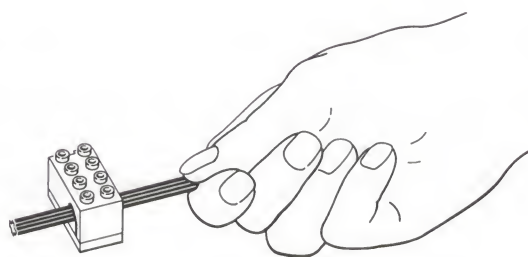
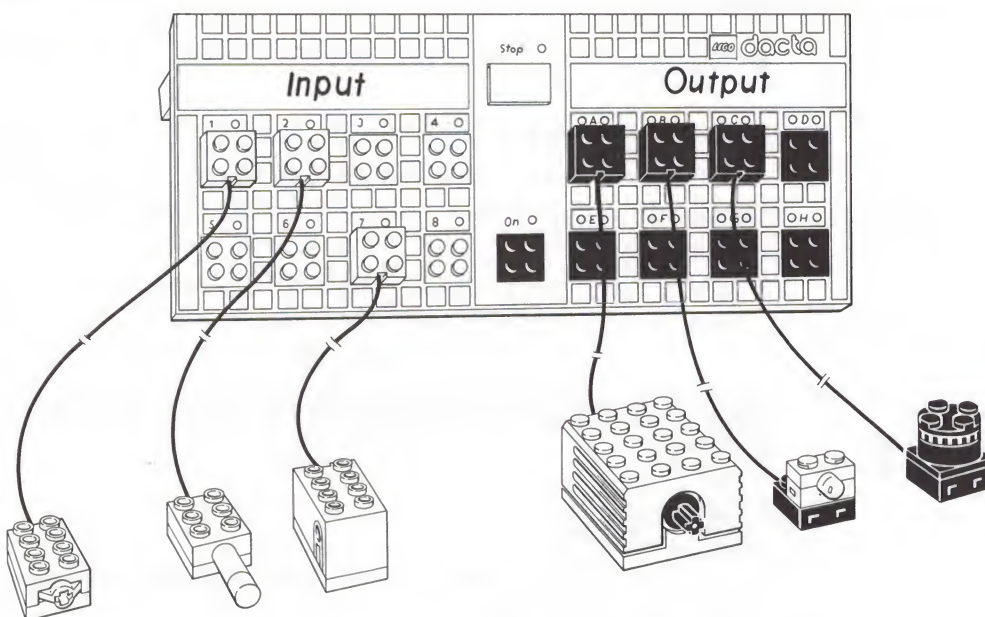
```
waituntil [temp2 < 26] talkto "motora off"
```

This example uses 26. The "<" symbol means "less than."

Since the tip is no longer being warmed, its temperature begins to drop. When the temperature reading is less than the number you typed in, LEGO DACTA® Control Lab turns off the motor.

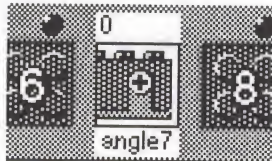
Angle Sensor

► Clip the connecting lead of the blue angle sensor to input port 7 on the LEGO DACTA Serial Interface.



► Insert an axle through the + shaped hole in the angle sensor. Turn the axle slowly in one direction and then in the other.

Note that the light above the input port blinks on and off, indicating that the sensor is changing values.



The angle sensor is a device which can report a wide range of positive and negative rotation values.

Type `angle7` as one word, with no quotation marks.

- Drag an angle sensor icon to input port 7 on the Setup page.

The angle sensor icon remains on input port 7 and the name becomes “angle7” automatically. The name “angle7” means that LEGO DACTA® Control Lab expects that an “angle” sensor is connected to input port “7” on the interface box.

The angle sensor connection you made on the Setup page corresponds to the actual sensor connection you made on the LEGO DACTA Serial Interface.

- Gently grasp the axle and turn it slowly once more. What happens?

The angle sensor number changes as the axle moves.

The numbers represent the angle of turning. One complete turn is 16 units.

- Now reverse the direction of your turning. What happens?

As you turn in one direction, the numbers increase. The numbers decrease when you turn in the other direction. This means that the angle sensor reports both the amount and the direction of turning.

- In the Command Center, type the following line and press Return or Enter.

```
show angle7
120
```

When you press Return or Enter, Control Lab prints the angle reading at that moment on the next line in the Command Center.

- Select a number higher than the current angle sensor reading.

For example, if the current reading is 120, you can select 150.

- Make sure that the sound element is still connected to output port C.

- Type the following line in the Command Center and press Return or Enter. Remember to substitute your number for 150.

Make sure you use square brackets. The ">" symbol means "greater than."

Make sure you type one space before and one space after the ">" symbol.

```
waituntil [angle7 > 150] talkto "soundc on"
```

- Gently grasp the axle and turn it slowly with your fingers so that the number increases.

The blue angle sensor can report the amount of turning up to speeds of about 500 revolutions per minute. Above that speed, the angle sensor readings are not reliable.

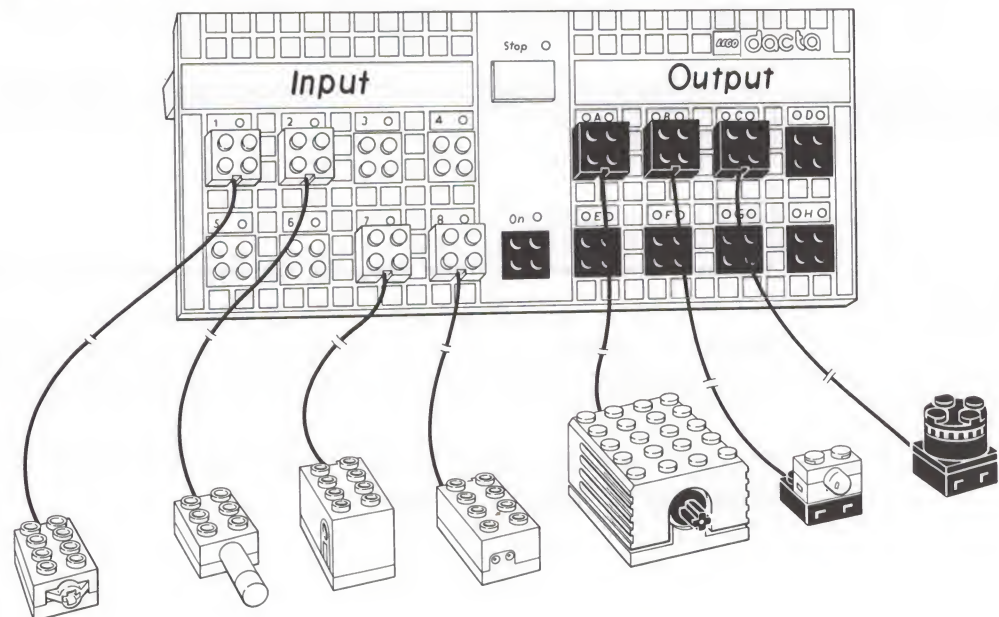
When the angle number is greater than the number you typed in, LEGO DACTA® Control Lab turns on the sound element.

- Turn off the sound element by typing `off` in the Command Center and press Return or Enter.

Light Sensor

The light sensor can "see" reflected and ambient light (the light in the room around the sensor.)

- Clip the connecting lead of the blue colored light sensor to input port 8 on the LEGO DACTA Serial Interface.



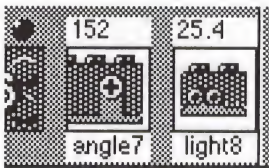
A small red light at the end of the light sensor begins shining.

The actual light sensing mechanism is housed in the clear window next to the red light on the sensor.

► Drag a light sensor icon to input port 8 on the Setup page.

The light sensor icon remains on input port 8 and the name becomes “light8” automatically. The name “light8” means that LEGO DACTA® Control Lab expects that a “light” sensor is connected to input port “8” on the LEGO DACTA Serial Interface.

The light sensor connection you made on the Setup page corresponds to the actual sensor connection you made on the interface box.



The light sensor is a device which can report a range of specific values for light intensity.

A number appears over the light sensor icon on the screen. This means that the sensor and interface box are sending numbers to the computer. The numbers represent the intensity of the light.

► Pick up the light sensor and point it toward various objects both dark and light. Observe how the numbers change.

► What is the highest number you can produce? What is the lowest?

In general, the more light that enters the sensor, the higher the number it reports. Therefore, light objects report higher numbers and darker objects report lower numbers.

► In the Command Center, type the following line and press Return or Enter.



Type `light8` as one word, with no quotation marks.

When you press Return or Enter, Control Lab prints the light reading at that moment on the next line in the Command Center.

► Select a number about in the middle of all the numbers you produced with the light sensor.

Make sure you use square brackets. The ">" symbol means "greater than."

Make sure you type one space before and one space after the ">" symbol.

The example below uses the number 35.

- Make sure the lamp is still connected to output port B.
- Place the light sensor in a dark area so that it reports a low number.
- Then type the following line in the Command Center and press Return or Enter. Remember to substitute your number for 35.

```
waituntil [light8 > 35] talkto "lamp on"
```

- Move the light sensor slowly toward something giving off more light.
- Watch the `light8` numbers as they increase.

When the light sensor number is greater than the number you typed in, LEGO DACTA Control Lab turns on the lamp.

- Turn off the lamp by typing `off` in the Command Center and pressing Return or Enter.
- Choose Quit from the File menu to shut down the Control Lab software. Click "no" at the dialog box asking if you want to save the project.

Saving a project is covered in the *Quick Start Guide* section page 18.

Exploration 4 Summary

Now you know how to:

- Attach all four sensors to the appropriate yellow or blue input ports: touch, temperature, angle and light.
- Use all four sensors to control a motor, lamp and sound element.

Here is a summary of the commands you have learned to use with the sensors.

Command	Example	Action of Example
show	show temp2	Displays the current reading of the temperature sensor connected to port 2.
waituntil	waituntil [touch1]	Makes computer pause until the touch sensor connected to input port 1 is pressed and reports "true"
>	temp2 > 29	Reports "true" when the reading from the temperature sensor connected to input port 2 is greater than 29, otherwise reports "false."
<	angle7 < 150	Reports "true" when the reading from the angle sensor connected to input port 7 is less than 150, otherwise reports "false."

Introductory Explorations Summary

Congratulations! You have now completed the *LEGO DACTA® Control Lab Setup Guide and Introductory Explorations*. By using this book, you have learned a lot about the LEGO DACTA® Serial Interface and the motors, lamps, sound elements and sensors which connect to it.

From here, you should go to the *Quick Start Guide*. These activities will introduce you to even more capabilities of Control Lab.

Introductory Explorations Progress Checklist

Exploration 1: The Motor, Lamp, and Sound Elements

- ☐ Make sure the LEGO DACTA® Serial Interface is connected to the computer and is being powered by the transformer.
- ☐ From the LEGO DACTA Technology building set (item #9701), take out one motor, one lamp, one sound element, and one connecting lead.
- ☐ Pick up the connector plate on the end of the connecting lead. Find the small metal parts in the studs on top of the connector plates at the ends of the wires.
- ☐ Find the metal edges in the recessed bottom of the connector plate.
- ☐ Examine the motor, lamp and sound element. Find the metal components which provide an electrical path through the element.
- ☐ Clip the bottom of one connector plate to the test port on the interface box. Let the connecting lead hang down from the test port toward the bottom of the interface box.
- ☐ Clip the bottom of the sound element to the four studs on top of the other connector plate.
- ☐ Grasp the top of the sound element and turn it. Listen to the sound.
- ☐ Explore how to control the sound by turning the top of the sound element.
- ☐ Does the sound element work if it is clipped onto only two of the four studs on the connector plate? Be sure to turn the top of the sound element to all four positions.
- ☐ If the connector plate is fastened to the studs on top of the sound element, is any sound produced?
- ☐ Replace the sound element with the lamp. Notice that the lamp lights up when it is clipped to the top or the bottom of the connector plate.
- ☐ Put the lamp aside and clip the motor to the connector plate.
- ☐ Explore the possible connection combinations.
- ☐ Can you find any connections for which the motor does not run?
- ☐ Can you connect both the sound element and the lamp to the end of the connecting lead to produce both light and sound? Can you connect the motor, the lamp and the sound element so that all three are running at once?
- ☐ Disconnect all elements from the connecting lead. Disconnect the connecting lead from the test port.

Exploration 2: LEGO DACTA® Control Lab Software - Making Connections

- ☐ Make sure the LEGO DACTA Serial Interface, transformer and cable are installed properly.
- ☐ Turn on the computer.
- ☐ Start the Control Lab software.
- ☐ Click on the Control Lab title screen and wait until it has changed.
- ☐ Test the interface box by pressing the red Stop button once.
- ☐ Push the Stop button a second time to restore power to the output ports.
- ☐ Locate the Command Center: it is the window near the bottom of the screen. Do not type any commands just yet.
- ☐ Select New Project from the File menu.
- ☐ Now look at the interface box itself. Clip one end of a connecting lead to the black output port marked with the letter A, so that the wire hangs down toward the bottom of the box.
- ☐ Connect the other end of the connecting lead to a motor.
- ☐ Select a motor icon with the mouse and drag it to output port A on the Setup page. Release the mouse button.
- ☐ Using the mouse, point to one of the two small circles above the `motora` icon on the Setup page. Press down the mouse button. What happens?
- ☐ Click and hold the pointer in the other circle above port A. What happens?
- ☐ Clip one end of a second connecting lead to the black output port marked with the letter B, so that the wire hangs down toward the bottom of the box. Connect the other end of the connecting lead to a lamp.
- ☐ Select a lamp icon with the mouse and drag it to output port B on the Setup page. Release the mouse button. What happens?
- ☐ Point to one of the two small circles above the `lampb` icon on the Setup page and press down the mouse button. What happens?
- ☐ Click and hold in the other circle above port B. What happens?
- ☐ Clip one end of a third connecting lead to the black output port marked with the letter C. Connect the other end to a sound element.
- ☐ Select a sound icon with the mouse and drag it to output port C on the Setup page.
- ☐ Point to one of the two small circles above the `soundc` icon on the Setup page and press down the mouse button. What happens?
- ☐ Click and hold in the other circle above output port C. What happens?

Exploration 3: LEGO DACTA® Control Lab Software - Using Commands

- ☐ Turn on the computer and start the Control Lab software.
- ☐ Connect the motor to output port A, the lamp to output port B, and the sound element to output port C.
- ☐ Drag the corresponding icons to the respective ports on the Setup page.
- ☐ Click in the Command Center window immediately beneath the word "Welcome" to insert the text cursor.
- ☐ Type the following line at the keyboard and press Return (Macintosh) or Enter (MS-DOS).

```
talkto "motora
```

- ☐ Type `on` and press Return or Enter.
- ☐ Press the red Stop button on the LEGO DACTA® Serial Interface once. What happens?
- ☐ Press the Stop button a second time. What happens?
- ☐ Type `off` and press Return or Enter to turn off the motor.
- ☐ Turn on the motor once more.
- ☐ Use the `talkto`, `on` and `off` commands to control the lamp and sound element.
- ☐ Type `alloff` or `ao` and press Return or Enter to turn off everything connected to the LEGO DACTA® Serial Interface.
- ☐ Type `cc` and press Return or Enter to clear everything you have typed in the Command Center.
- ☐ Type the following in the Command Center and press Return or Enter. What happens?

```
☐ talkto "soundc
on
rd
```

- ☐ To reverse the direction once more, simply use the up-arrow key (↑) to bring the text cursor to the `rd` line in the Command Center. Then press Return or Enter. Or you can simply type `rd` again.
- ☐ Type the following in the Command Center. What happens?

```
☐ talkto "motora
on
rd
off
```

- ☐ Type the following, all on the same line, in the Command Center. What happens?

```
talkto "lampb on wait 30 off
```

- ☐ Change 30 to 50. Then press Return or Enter. What happens?
- ☐ Type the following in the Command Center. What happens?

```
talkto "motora onfor 40
```

Exploration 4: LEGO DACTA® Control Lab Software - Using Sensors

- ☐ Turn on the computer and start the Control Lab software. Connect the motor to output port A, the lamp to output port B and the sound element to output port C.
- ☐ Drag the corresponding icons to the respective ports on the Setup page.
- ☐ Now look at the LEGO DACTA Serial Interface itself. Find the yellow and blue input ports numbered 1 through 8 on the left side of the interface box.
- ☐ Find the small notch or channel at the back end of each sensor.

Touch Sensor

- ☐ Clip the end of the connecting lead of the yellow touch sensor to input port 1.
- ☐ Press the button on the touch sensor and observe the indicator light above input port 1 on the LEGO DACTA Serial Interface.
- ☐ Drag a touch sensor icon to input port 1 on the Setup page.
- ☐ Push in and hold down the touch sensor switch and observe what happens to the word "false."
- ☐ Release the switch. What happens?
- ☐ In the Command Center, type the following line and press Return or Enter.

```
show touch1  
false
```


- ☐ Push in on the touch sensor switch and type the line once again, or use the arrow keys to move the text cursor up to the line you typed a moment ago. Press Return or Enter. What happens?
- ☐ Without pressing the touch sensor, type the following line in the Command Center and press Return or Enter.

```

☐
waituntil [touch1] talkto "motora onfor 40●
|

```

- ☐ Wait as long as you like, then press the touch sensor. What happens?
- ☐ Experiment in a similar fashion with the touch sensor but replace the motor with the lamp or the sound element. For example, try these statements in the Command Center. Remember to press Return or Enter. Press the touch sensor to activate the lamp or motor.

```

☐
waituntil [touch1] talkto "lamb onfor 40●
|

```

```

☐
waituntil [touch1] talkto "soundc onfor 25 rd onfor 25●
|

```

Temperature Sensor

- ☐ Clip the connecting lead of the temperature sensor to input port 2 on the LEGO DACTA® Serial Interface.
- ☐ Drag a temperature sensor icon to input port 2 on the Setup page.
- ☐ Gently grasp the metallic tip of the probe with your fingers to warm it up.
- ☐ After the temperature changes, release the probe.
- ☐ In the Command Center, type the following line and press Return or Enter.

```

☐
show temp2
22.8
|

```

- ☐ Select a number which is a few degrees higher than the current temperature sensor reading and which you can obtain with the heat from your fingers. Write the number here ____.

- ☐ Make sure that the motor is still connected to output port A.
- ☐ Type the following line in the Command Center and press Return or Enter. Remember to substitute your number for 27.

```
waituntil [temp2 > 27] talkto "motora on"
|
```

- ☐ Warm the metallic tip of the probe by grasping it again.
- ☐ Release the probe.
- ☐ Quickly, before the temperature drops, select a number one or two degrees below the temperature reading. Type the following in the Command Center or change the above line to read as follows. Press Return or Enter. Remember to substitute your number for 26.

```
waituntil [temp2 < 26] talkto "motora off"
|
```

Angle Sensor

- ☐ Clip the connecting lead of the blue angle sensor to input port 7 on the LEGO DACTA® Serial Interface.
- ☐ Insert an axle through the + shaped hole in the angle sensor. Turn the axle slowly in one direction and then in the other.
- ☐ Drag an angle sensor icon to input port 7 on the Setup page.
- ☐ Gently grasp the axle and turn it slowly once more. What happens?
- ☐ Now reverse the direction of your turning. What happens?
- ☐ In the Command Center, type the following line and press Return or Enter.

```
show angle7
120
```

- ☐ Select a number higher than the current angle sensor reading.
- ☐ Make sure that the sound element is still connected to output port C.
- ☐ Type the following line in the Command Center and press Return or Enter. Remember to substitute your number for 150.

```
waituntil [angle7 > 150] talkto "soundc on"
|
```


- ☐ Gently grasp the axle and turn it slowly with your fingers so that the number increases.
- ☐ Turn off the sound element by typing `off` in the Command Center and press Return or Enter.

Light Sensor

- ☐ Clip the connecting lead of the blue colored light sensor to input port 8 on the LEGO DACTA® Serial Interface.
- ☐ Drag a light sensor icon to input port 8 on the Setup page.
- ☐ Pick up the light sensor and point it toward various objects both dark and light. Observe how the numbers change.
- ☐ What is the highest number you can produce? What is the lowest? Write the numbers here: Highest ____ Lowest ____.
- ☐ In the Command Center, type the following line and press Return or Enter.

```
☐ show light8  
26.1
```

- ☐ Select a number about in the middle of all the numbers you produced with the light sensor. Write the number here: Middle ____.
- ☐ Make sure the lamp is still connected to output port B.
- ☐ Place the light sensor in a dark area so that it reports a low number.
- ☐ Then type the following line in the Command Center and press Return or Enter. Remember to substitute your number for 35.

```
☐ waituntil [light8 > 35] talkto "lamp on"  
|
```

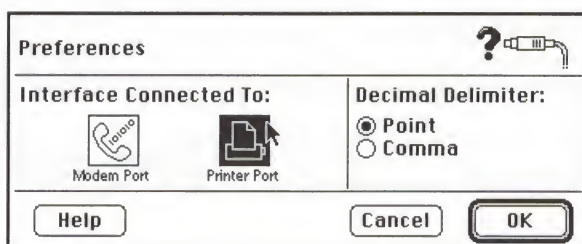
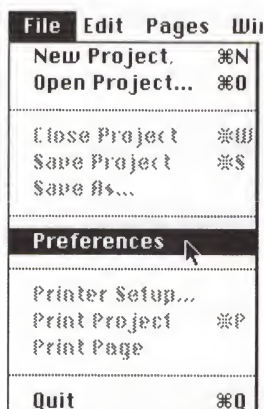
- ☐ Move the light sensor slowly toward something giving off more light.
- ☐ Watch the `light8` numbers as they increase. When the light sensor number is greater than the number you typed in, LEGO DACTA Control Lab turns on the lamp.
- ☐ Turn off the lamp by typing `off` in the Command Center and pressing Return or Enter.
- ☐ Choose Quit from the File menu to shut down the Control Lab software. Click "no" at the dialog box asking if you want to save the project.

Troubleshooting Help

If you see the error message "Can't find the Control Lab interface box." while trying to load the software, it may mean that the LEGO DACTA® Serial Interface and transformer are not connected properly. Turn the computer off and check the connections. Review the connection steps in the *Setup Guide* on page 9. Then turn the computer back on and try starting the LEGO DACTA Control Lab software once more.

Macintosh users: If you attached the cable to the printer port instead of the modem port, select Preferences from the Control Lab File menu.

Click on the printer port icon to change the setting of the dialog box from Modem to Printer, and then click OK.



MS-DOS users: If you attached the cable to COM2 instead of COM1, select Preferences from the Control Lab File menu. Click on COM2 to change the setting of the dialog box from COM1 to COM2. Then click OK.

Here is a brief troubleshooting chart to follow if necessary.

Computer Message	Action To Take
Can't find the interface box	<p>Make sure the cable is connected snugly to the interface box and that the other end is securely inserted in the modem or COM1 port.</p> <p>Also, make sure the transformer is plugged in and that the green "On" light on the interface box is shining.</p> <p>If this message appears while you have a project open, pull out the cable from the back of the computer and reconnect it. Then click in the Control Lab project area to see if communication is reactivated. If communication is not restored, save the project, Quit Control Lab and check the computer, cable and interface box connections again.</p>
Not enough memory	Save and Quit out of any other software programs you may have running.
Or, use a computer with more memory.	<p>See the technical specifications in the <i>Setup Guide</i> on page 4.</p> <p>Macintosh users: Quit out of Control Lab. Click to select the Control Lab icon. Select Get Info from the File menu. Change the Application Memory Size (K) to a smaller amount (cannot be less than 1024 K.)</p>

Teacher note:

If the system still does not work properly, write down any error messages and call LEGO Dacta at 800-527-8339. Ask for technical support.

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